

YOUNG'S DOUBLE SLIT ANSWERS

1. $\lambda = 6.328 \times 10^{-7} \text{ m}$
 $d = 43 \mu\text{m}$
 $= 43 \times 10^{-6} \text{ m}$
 $L = 2.5 \text{ m}$
 $m = 1$
 $x_m = ?$

$$m\lambda = \frac{dx_m}{L}$$

$$x_m = \frac{m\lambda L}{d}$$

$$x_m = \frac{(1)(6.328 \times 10^{-7} \text{ m})(2.5 \text{ m})}{43 \times 10^{-6} \text{ m}}$$

$$x_m = 3.7 \times 10^{-2} \text{ m}$$

2. $\lambda = 450 \text{ nm}$
 $= 450 \times 10^{-9} \text{ m}$
 $d = 3.0 \times 10^{-6} \text{ m}$
 $m = 1$
 $\theta = ?$

$$d \sin \theta = m\lambda \Rightarrow \sin \theta = \frac{m\lambda}{d}$$

$$\sin \theta = \frac{(1)(450 \times 10^{-9} \text{ m})}{3.0 \times 10^{-6} \text{ m}}$$

$$\theta = 8.6^\circ$$

3. $\lambda = 490 \text{ nm}$
 $= 490 \times 10^{-9} \text{ m}$
 $d = 6.0 \times 10^{-6} \text{ m}$
 $L = 1.3 \text{ m}$
 $m = 2\frac{1}{2}$
 $x_m = ?$

$$x_m = \frac{m\lambda L}{d} \text{ (from \#1)}$$

$$= \frac{(2.5)(490 \times 10^{-9} \text{ m})(1.3 \text{ m})}{6.0 \times 10^{-6} \text{ m}}$$

$$= 2.6 \times 10^{-1} \text{ m}$$

4. $PS_1 = 35.0 \text{ cm}$
 $= 0.350 \text{ m}$
 $PS_2 = 42.0 \text{ cm}$
 $= 0.420 \text{ m}$
 $d = 0.112 \text{ m}$
 $f = 10.5 \text{ Hz}$

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4. $PS_1 = 0.350\text{m}$
 $PS_2 = 0.420\text{m}$
 $d = 0.112\text{m}$
 $f = 10.5\text{Hz}$
 $m = 2^{1/2}$
 $\lambda = ?$
 $v = ?$

$$m\lambda = |PS_2 - PS_1|$$

$$\lambda = \frac{|PS_2 - PS_1|}{m}$$

$$= \frac{|0.420\text{m} - 0.350\text{m}|}{2.5}$$

$$= 2.80 \times 10^{-2}\text{m}$$

$$v = f\lambda$$

$$= (10.5\text{Hz})(2.80 \times 10^{-2}\text{m})$$

$$= 2.94 \times 10^{-1}\text{m/s}$$

5. $\lambda = 600\text{nm}$
 $= 600 \times 10^{-9}\text{m}$
 $L = 1.5\text{m}$
 $x_m = 13.2\text{cm}$
 $= 0.132\text{m}$
 $d = ?$
 $m = 10.5$

$$m\lambda = \frac{d x_m}{L} \Rightarrow d = \frac{m\lambda L}{x_m}$$

$$d = \frac{(10.5)(600 \times 10^{-9}\text{m})(1.5\text{m})}{0.132\text{m}}$$

$$d = 6.8 \times 10^{-5}\text{m}$$

$m = 1$
 $\lambda = 450\text{nm}$
 $x_m = ?$

$$x_m = \frac{m\lambda L}{d}$$

$$= \frac{(1)(450 \times 10^{-9}\text{m})(1.5\text{m})}{6.8 \times 10^{-5}\text{m}}$$

$$= 9.9 \times 10^{-3}\text{m}$$